# Preeclampsia

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# HYPERTENSION IN PREGNANCY

- Diastolic BP ≥ 110 mmHg on any one occasion
- or diastolic BP ≥ 90 mmHg on 2 or more consecutive occasions ≥ 4 h apart, not measured during labour.
- Mild > 140/90
- Moderate > 150/100
- Severe > 160/110

# BLOOD PRESSURE MEASURMENT

- Use of the mercury sphygmomanometer - the gold standard
- measured with the woman seated/ feet supported or on the ground/ the arm at the level of the heart
- Appropriate cuff/ KORATKOFF V for measuring Diastolic pressure

# HYPERTENSION IN PREGNANCY

## Chronic Hypertension

- Known Hypertensive or Hypertension presenting before 20th weeks of gestation
- Hypertension diagnosed after 20th week not normalising after 12 weeks post partum
- complicates 3-5% of pregnancies and doubles the risk of preeclampsia.

## Gestational Hypertension (Pregnancy Induced Hypertension)

- New hypertension presenting after 20 weeks gestation without significant proteinuria
- resolves within 6 weeks of delivery.
- occurs in 6-7% of pregnancies
- 15-25% - develop pre-eclampsia.
- tends to recur in subsequent pregnancies

# PREECLAMPSIA

- a multisystem disorder
- occurring after the 20th week of pregnancy
- with variable features, severity and rate of progress
- occurs in 2–3% of all pregnancies
- increase in morbidity and mortality for both mother and child

# SUPERIMPOSED PREECLAMPSIA

- New onset proteinuria after 20$^{th}$ week of gestation in a patient with chronic hypertension

# PREECLAMPSIA

- ❖ Risk factors
- Maternal
- Paternal

❖ Maternal causes

- Inherent

  * Genetic predisposition
  * Extremes of age
  * Nulliparity
  * Prior or family history of Preeclampsia or cardiovascular disease
  * woman born small for gestational age
  * Afro-carribean origin

Maternal causes

- Medical conditions
  * Chronic Hypertension
  * Diabetes Mellitus( Type 1 or Gestational)
  * Chronic renal disease
  * Connective tissue disorders
  * Stress

  ( Smoking???)

Maternal causes

- Pregnancy specific
  * Multiple gestation
  * New partner
  * H mole/ Hydrops fetalis
  * Fetal structural anomalies
  * Oocyte donations
  * UTI

Paternal causes

- A partner who fathered a preeclamptic mother previously
- A first time father
- Barrier contraception
- Donor insemination

# AETIOLOGY

- precise aetiology still unknown ( DISEASE OF THEORIES)
- Ancient Greeks ( WONDERING WOMB)
- CURRENT THEORIES

❖ genetic predisposition

❖ an autoimmune reaction against the placenta

# PATHOPHYSIOLOGY

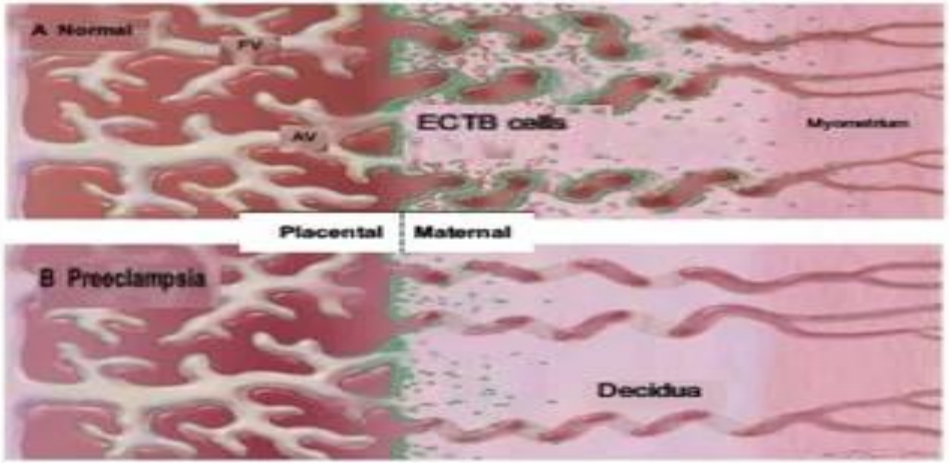



**Fig. 1. Invasion defects in preeclampsia.** (A) In a normal placenta, extravillous cytotrophoblast (ECTB) cells (green) move into the decidua (endometrium) and myometrium via interstitial invasion. Some ECTB cells enter maternal spiral arteries and replace the endothelial cells of the vessel walls, becoming endovascular ECTB (eECTB) cells, increasing vessel compliance and maximizing blood flow into placental blood spaces. (B) In the placenta of a preeclamptic patient, interstitial invasion is shallow and limited, with many ECTB cells in the basal plate remaining attached to anchoring villi (AV). Endovascular invasion is nearly absent, and spiral arterioles remain 'stiff'. FV, floating villi. Image courtesy of The Curators of the University of Missouri (2011), a public corporation.

Deficient placental implantation and platelet aggregation within the placental bed

↓

placental ischaemia and release of Vasoactive substances

↓

widespread endothelial damage and Platelet adherence/ Increased vascular permeability

↓

profound vasospasm with multisystem effects

- Prostaglandin metabolism is also disordered
- Increase in thromboxane and a decrease in prostacyclin concentrations
- leading to platelet dysfunction and further vasoconstriction

# SYSTEMIC EFFECTS OF PREECLAMPSIA

**Maternal**

**CVS**

- Widespread vasoconstriction
- Normal or increased systemic vascular resistance
- Left ventricular failure
- Increased vascular permeability and oedema
- Decreased circulating blood volume

# CENTRAL NERVOUS SYSTEM

- Headaches
- Visual disturbances
- Hyper-reflexia
- Cerebral haemorrhage
- Convulsions

# RENAL INVOLVEMENT

- Reduced GFR
- Reduced urea clearance and increased uric acid concentrations
  (BU > 6.0 mg dl associated with pre-eclampsia)
- Proteinuria and hypoproteinaemia
  (total protein excretion ≥ 300 mg per 24 h/
  2 specimens of urine collected ≥ 4 h apart with ≥ 2+ on the protein reagent strip)
- Oliguria
- Acute renal failure

# RESPIRATORY SYSTEM

- Pulmonary oedema
- Facial and laryngeal oedema
- Adult respiratory distress syndrome

# LIVER

- Abnormal liver function tests
- Subcapsular haemorrhage and epigastric pain
- Liver rupture

# COAGULATION

- Increased turnover of fibrinogen, fibrin and platelets
- Thrombocytopaenia
- Impaired platelet function
- DIC
- HELLP syndrome (haemolysis, elevated liver enzymes, low platelets)

# FETAL

- Decreased placental perfusion
- Placental ischaemia and infarction
- IUGR
- Placental abruption
- Preterm labour

# SEVERE PREECLAMPSIA

❖ any one of the following occurring after the 20th week of pregnancy

(i) severe hypertension (SBP> 160 mmHg or DBP > 110 mmHg)

(ii) proteinuria > 5 g per 24 h

(iii) oliguria < 400 ml per 24 h

(iv) cerebral irritability

(v) epigastric or right upper quadrant pain (liver capsule distension)

(vi) pulmonary oedema

# ECLAMPSIA

- occurrence of convulsions in a woman with pre-eclampsia ( with no other attributable cause)
- 1 in 2000 deliveries in the industrialised world
- Cerebral vasoconstriction/ ischemia/ vasogenic oedema
- Incidence - ante-partum (40%)/intra-partum (20%) / post-partum (40%)
- Severe preeclamptics are at a higher risk
- risk not increased with higher BP

# HELLP SYNDROME

- Haemolysis, elevated liver enzymes and low platelet count
- occur with severe pre-eclampsia
- hepatic ischaemia with periportal haemorrhage and necrosis
- Partial HELLP - only 1 or 2 of the criteria are present

# HELLP SYNDROME CTD.....

- may occur when hypertension or proteinuria is absent or minimal
- 20% of cases - post-partum
- may be asymptomatic
- may present with epigastric/right hypochondrial pain, malaise, N & V

# HELLP SYNDROME CTD.....

Differential diagnosis

- acute fatty liver of pregnancy
- Cholestasis
- viral hepatitis
- thrombocytopaenia from other causes( HUS/ TTP)
- Early haemolysis can be detected by measuring serum haptoglobin concentrations.

# HELLP SYNDROME CTD.....

- Rapidly worsens for 24–48 h
- resolves within 6 days
- Increased maternal and fetal morbitity
- Increased risk of other complications of preeclampsia

# MANAGEMENT OF PRE-ECLAMPSIA

- Early diagnosis
- control of blood pressure
- prevention of convulsions
- timely delivery

# ANTIPLATELET THERAPY

- Patients with high risk of Preeclampsia
- 75 mg of aspirin daily from 12 weeks up to 36 weeks ( CLASP TRIAL)

- Close monitoring with frequent Blood pressure readings
- Good IV access
- CVP guided , goal directed fluid therapy
- Meticulous fluid balance

**Ix**

- Full blood count, RFT and LFT
- If platelet count < 100,000- Other clotting studies

# Control of blood pressure

- Target MAP -100–140 mmHg (130/90–170/110 mmHg)
- Anti-hypertensive therapy
- Avoid sudden drops

# ANTIHYPERTENSIVES IN PREECLAMPSIA

❖ **Nifedipine**

*Administration*

- Use orally or sublingually.
- 10mg nifedipine, repeated after 30 minutes.
- Maintenance dose - 8 hourly, maximum dose - 20mg.

❖ *Adverse effects*

- Sublingual use -rapid profound BP
- Use cautiously with $MgSO_4$ (both antagonise calcium).

# LABETALOL

❖ *Administration*

• 5-20mg boluses slowly IV at 10 minute intervals to a maximum of 50mg.

• IV infusion - 20 mg/hour.

-Double infusion in 30 minute intervals

-maximum -160 mg/hour.

• oral : 200-1600mg in divided doses

- Absorption may be reduced in labour.

❖ *Contraindications*

• Asthma and cardiac failure

# HYDRALAZINE

- *Mode of action*

- Direct acting arterial vasodilator.

- *Administration*

• Never infuse hydralazine via the same cannula as magnesium sulphate –avoid using the same arm

- IV 5mg incremental boluses or 5-20mg/hr infusion
- Side effects- Headache/ tremors/ vomiting- may mimic eclampsia

# METHYL DOPA

- Centrally acting- reduces sympathetic outflow
- Dose- 1-3g/day in 3-4 divided doses PO
- Side effects- drowsiness/ depression / postural hypotension

# Mg Therapy

- Not used as an antihypertensive
- In severe preeclampsia with fx of CNS irritability

# FLUID THERAPY

- Reduced plasma volume of 30–40%
- IV therapy is often necessary
- Inverse relationship between intravascular volume and severity of hypertension
- Volume expansion - reduce SVR and SBP

BUT- Risk of pulmonary oedema

- Increased risk of pulmonary oedema

- low colloid oncotic pressure (Crystalloids causes a further decrease )
- left ventricular dysfunction (colloid will increase the CVP )

- Optimum fluid therapy is difficult to achieve

# FLUID THERAPY CTD

- Crystalloids - 1–2 ml /kg/hr

( **Limit maintenance to 80 ml/hr** if no ongoing losses

**NICE GUIDELINES- 2010)**

- colloids if CVP and serum albumin are low
- Blood and blood products - as necessary
- Oliguria - treated with a fluid challenge of 250 ml of crystalloid
- CVP monitoring If there is no response
- Target CVP - 3–5 mmHg and a UOP> 0.5ml /kg/hr

# DELIVERY

- close collaboration of obstetric, paediatric and anaesthetic teams
- Adequate optimisation prior to delivery- blood pressure control / adequate fluid resuscitation
- Supine hypotension avoided by l/lateral displacment
- Prolong labour> 32 weeks till fetal lung maturity/ place of IM steroids

# LABOUR




Epidural analgesia -preferred choice for labour

- controlling of blood pressure
- improving placental perfusion due to vasodilatation.
- reduces the stress response and release of catecholamines which occurs with pain.

# EPIDURAL ANALGESIA FOR LABOUR

- A platelet count < 50,000 - absolute contraindication
- Platelet count of 50–100,000 acceptable if rest of coagulation screen is normal
- BT gives a better indication of platelet function ( significant operator variability)
- TEG If available
- Fluid preloading may precipitate pulmonary oedema

# ANAESTHESIA FOR C-SECTION

- Regional anaesthesia - the preferred choice
- epinephrine in epidural mixtures - avoided
- fentanyl - improve the sensory component of the block
- altered pharmacokinetics of lidocaine (*e.g.* reduced drug clearance)
- Bupivacaine or ropivacaine - better

- severity of hypotension similar in spinal or epidural
- uteroplacental perfusion not reduced – may increase
- Spinals or CSE techniques increasingly used

Hypotension after regional techniques

- treated with a combination of crystalloid, colloid and ephedrine( risk of pulmonary oedema)
- Sensitivity to vasopressors increased
- ephedrine - administered cautiously in low doses
- Phenylephrine - alternative

# GENERAL ANAESTHESIA

- Emergency Caesarean sections
- failed regional techniques
- regional techniques are contra-indicated
- Post-ictal patient with low GCS
- patients with recurrent seizures
- Presence of pulmonary oedema associated with hypoxia

- Airway assessment (air way oedema)
- Possible difficult intubation
- Awake intubation - safest approach
- Nasal/ oral intubation –risk of significant bleeding (venous engorgement, disordered coagulation
- Exaggerated Intubation response

# GENERAL ANAESTHESIA

❖ Drugs used to obtund the hypertensive response to laryngoscopy and intubation

- magnesium sulphate 40 mg $kg^{-1}$
- Short acting opiods (*e.g.* alfentanil 10 ∝g $kg^{-1}$)
- β-blockers (*e.g.* esmolol 0.5 mg $kg^{-1}$ or labetalol 10–20 mg)
- lidocaine (1.5 mg $kg^{-1}$ given 5 min prior to intubation

- Maintenance- Isoflurane better
- Continuos monitoring hemodynamic/ respiratory parameters+ Fluid balance
- Extubation - an exaggerated cardiovascular response
- Esmolol or lidocaine
- Magnesium/CCB - prolong the effects of depolarising and NDMB / reduce fasciculations with succinylcholine
- Nerve stimulators - used in all cases
- Laryngeal oedema may worsen during surgery
- ETTcuff - deflated to ensure cuff leak prior to extubation

# REASONS FOR PROLONGED RECOVERY AFTER GA

- Effect of excess anaesthetic agents
- Effect of excess opiates
- Inadequate reversal of neuromuscular block: magnesium potentiates NDMB'S
- Respiratory depression due to magnesium toxicity
- Hypoglycaemia
- intracranial event

# USE OF OXYTOCIC AGENTS

- Syntocinon- drug of choice
- Ergometrine – to be avoided
- Prostaglandin analogues( PDF 2 [a])
  - risk of aggrevation of hypertension

# POST-DELIVERY

- pre-eclampsia may worsen after delivery/up to 30% of cases- only diagnosed post-partum
- HDU/ ICU care with close observation
- control of blood pressure
- Meticulous fluid balance- Fluid overload avoided
- Use of invasive monitoring if necessary

❖ Anti-hypertensive treatment should be continued as long as is necessary

❖ Good analgesia to reduce the stress response caused by uncontrolled pain

- Epidural
- Opioids ( PCA)
- Paracetamol( CAUTION IN LIVER IMPAIREMENT)
- NSAIDS ( RISK OF BLEEDING IN COAGULOPATHY/ RENAL INSUFFICIENCY)

❖ Thromboprophylaxis

- To be considered in all cases

# ECLAMPSIA

- severity of hypertension does not correlate well with the incidence of convulsions
- Seizures are generalised and often self limiting
- **Magnesium sulphate – Treatment of choice for the convulsions**
  **prevention of recurrent fits**

# ECLAMPSIA MX

- Goals
  - Cessation of seizures
  - Stabilisation of A, B and C
  - Prevention of further seizures
  - Prevention of damage to and safe delivery of the foetus

❖ **The Magnesium Sulphate for Prevention of Eclampsia (MAGPIE) Trial- 2002**

( women with pre-eclampsia treated with magnesium sulphate had a 58% lower risk of eclampsia and a lower mortality rate compared to the placebo group)

❖ Mg therapy has also been found to be **effective in reducing Intubation, pneumonia and ICU admissions**

# MAGNESIUM THERAPY

- Exact mechanism of action is not known
  - **Antagonist at calcium channels reducing systemic and cerebral vasospasm**
  - **NMDA receptor antagonist - anticonvulsant action**
  - **Increased production of endothelial prostacyclin may restore thromboxane-prostacyclin imbalance**
- Close monitoring of oxygen saturation and patellar tendon reflexes (hourly) is necessary
- Magnesium crosses the placenta **( neonatal hypotonia and respiratory depression)**

# REGIMENS OF MGSO4 THERAPY

- **Collaborative Eclampsia Trial regimen- 1995**

**( A loading dose of 4 g is given over 5–10 min, followed by an infusion of 1 g $h^{-1}$ for 24 hours post delivery or last seizure whatever comes later**

**recurrent seizures - additional 2 g IV $MgSO_4$)**

- **ultra-short protocol of magnesium sulphate** (found to be effective in 92.6% eclamptic patients)

**( MgSO4 4 g IV followed by 10 g IM )**

# MAGNESIUM TOXICITY

| | mmol litre$^{-1}$ |
|---|---|
| Normal plasma level<br>(NB most magnesium is intracellular) | 1 |
| Therapeutic range | 2 - 3 |
| ECG changes | 3 – 5 |
| Loss of deep tendon reflexes | 5 |
| Muscle paralysis, Respiratory depression | 6 – 7.5 |
| Cardiac arrest | 12 |

# ECLAMPSIA MANAGEMENT....

- Phenytoin and diazepam have been widely used in the past- replaced by magnesium
- Any further treatment of seizures is supportive (*e.g.* intubation and ventilation).

# MX OF SPECIFIC COMPLICATIONS

❖ **Management of acute pulmonary oedema**

- 2.9% of pre-eclamptics ( 30% of cases – antepartum)
- stabilisation of the mother
- SpO2 monitoring
- oxygen supplementation either via NIV devices /intubation and ventilation
- IV furosemide - bolus 20–40 mg over 2 min
- repeated doses of 40–60 mg after approximately 30 min
- maximum dose 120 $mg.h^{-1}$

- IV morphine 2–5 mg
- fluid restriction and strict fluid balance
- positioning (head elevated )
- uterine displacement

**Management of oliguria in post partum**

- normal renal and respiratory function - requires no treatment
- use of furosemide or low-dose dopamine with normal RFT's- NOT RECOMMENDED
- Spontaneuos diuresis – occur after 24-48 hrs of delivery

**Management of acute renal decompensation**

Indications for haemodialysis

- persistent acidaemia
- -Hyperkalaemia
- -volume overload
- -Uraemia

Intensive care management

# NEW DEVELOPMENTS

- ❖ Ketanserin
- Increased serotonin levels in preeclamptics
- Serotonin 1 receptors in endothelial cells- Increased NO release
- Serotonin 2 receptor activation- Increased platelet activation and vasoconstriction
- As endothelial cells are damaged in preeclampsia- prominent action on S-2 receptors
- selective serotonin-2-receptor antagonist/ some antagonistic effects at α1-adrenoreceptors at high doses- reduced BP

# PAST QUESTIONS

- 1993 MD Anaesthesiology/ Essay

2.) Outline the clinical fx of Preeclampsia

Discuss the special problems in the administration of anaesthesia to a patient with severe preeclampsia

- 1995 MD Anaesthesiology/ Essay

3.) Discuss pre,intra and postop Mx of a patient with severe Preeclamptic toxaemia in the 36th week of Pregnancy

❖ 1999 MD Anaesthesiology/ Essay

2.) A patient is admitted to labour ward at 36 weeks of gestation with foetal distress and severe preclampsia. She needs an emergency c-section. How would you manage this patient?

- 2000 MD Anaesthesiology/ SAQ

9.) What are the therapeutic effects and side effects of magnesium sulphate therapy in preeclampsia?

How would you treat any toxicity that occur?

- 2006 MD Anaesthesiology/ SAQ

11.) What are the principles of Mx of Eclampsia?

- 2007 MD Anaesthesiology/ Essay

1.) Discuss the perioperative Mx of a lady who is 36 weeks pregnant with Preeclampsia who requires C-section.

❖ 2012 MD Anaesthesiology/ SAQ

- A 28 year old primigravida at 30 weeks' gestation is brought to the emegency department with a history of a headache and repeted fits. On examination, her BP is 170/110, heart rate 100/min, GCS 12/15. Her platelet count is 30,000/mm3 and INR 1.9

A. What is the immediate management?
B. How would you prepare this patient for an emergency c-section?
C. Describe your anaesthetic technique of choice?

# REFERENCES


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# THANK YOU!

